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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte JENNIFER WANG and MIKE BARSKY

Appeal 2009-005165
Application 10/781,353
Technology Center 2800

Decided: October 28, 2009

Before KENNETH W. HAIRSTON, MARC S. HOFF,
and THOMAS S. HAHN, *Administrative Patent Judges*.

HAHN, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellants invoke our review under 35 U.S.C. § 134(a) from the Examiner's final rejection of claims 21-27. We have jurisdiction under 35 U.S.C. § 6(b). An oral hearing was held on October 8, 2009.¹ We affirm.

¹ During the oral hearing, Appellant's counsel stated that appealed claim 21 is to be cancelled. No 37 C.F.R. § 41.33 authorized amendment to cancel

STATEMENT OF THE CASE

Appellants claim a device invention for a via, i.e., hole, in a polymer layer. The via has an aspect ratio greater than 1, and (as recited in some claims) a sub-micron wide opening, substantially the same opening diameter through at least one-half the depth, and a tapered sidewall.² Claims 21 and 22 are illustrative:

21. A device including a via produced by the process comprising the steps of:

placing a hard-mask on a polymer layer;

placing a photoresist mask on said hard-mask;

releasing a first fluoride gas into a chamber to etch a hard-mask opening for defining a via hole; and

releasing a second fluoride gas into said chamber to etch an exposed portion of said polymer layer defining said via hole with at least one vertical sidewall,

whereby the via hole comprises an aspect ratio which is greater than 1, and is of substantially the same diameter throughout the depth of the via hole.

22. A device including a via produced by the process comprising the steps of:

placing in a chamber a semiconductor substrate including a polymer layer defining a sub-micron wide via-opening deposited on said semiconductor substrate, and a hard-mask defining said sub-micron wide via-opening deposited on said polymer layer;

claim 21 has been filed. Therefore, this decision addresses the appealed final rejection of claim 21.

² See generally Spec. ¶¶ [0008], [0024]-[0027], and [0029]-[0034]; Figs. 2A-C, 3, 4A, and 5.

whereby the via comprises an aspect ratio which is greater than 1, and is of substantially the same diameter throughout at least one-half the depth of the via;

releasing a third fluoride gas into said chamber to etch said hard-mask and an exposed portion of said polymer layer proximal to said sub-micron wide via-opening thereby creating at least one tapered sidewall within a via.

The Examiner relies on the following prior art references to show unpatentability:

Yu	US 6,004,883	Dec. 21, 1999
Lin	US 2002/0068441 A1	June 6, 2002
Lin ('369)	US 6,515,369 B1	Feb. 4, 2003

1. The Examiner rejected claims 21, 22, and 25 under 35 U.S.C. § 102(b) as being anticipated by Lin ('369).
2. The Examiner rejected claim 21 under 35 U.S.C. § 103(a) as being unpatentable over Yu and Lin.
3. The Examiner rejected claims 23, 24, 26, and 27 under 35 U.S.C. § 103(a) as being unpatentable over Lin ('369).

Rather than repeat the arguments of Appellants or of the Examiner, we refer to the Briefs and the Answer³ for their respective details. In this decision, we have considered only those arguments actually made by Appellants. Arguments that Appellants could have made but did not make in the Briefs have not been considered and are deemed to be waived. *See* 37 C.F.R. § 41.37(c)(1)(vii).

Appellants' Arguments

Anticipation

Appellants assert that the Examiner idealized Lin ('369) figures 5A and 10 to conform to what he believes is the Lin ('369) invention, without written substantiation from Lin ('369) as to diameter, verticality, or tapering of via sidewalls (App. Br. 10, 11; Reply Br. 3).

Obviousness

Appellants address the rejection of claim 21 over Yu and Lin with assertions that the Examiner erred in finding the references teaching or suggesting verticality of via walls, and a via aspect ratio being greater than one (App. Br. 11-13).

In addressing the rejection of claims 23, 24, 26, and 27 over Lin ('369), Appellants assert that the reference inadequately teaches or suggests a tapered via sidewall extending at least a specified depth into a via (App. Br. 13, 14; Reply Br. 5).

³ We refer throughout this opinion to (1) the Appeal Brief filed June 20, 2008, (2) the Examiner's Answer mailed Oct. 7, 2008, and the Reply Brief filed Dec. 5, 2008.

ISSUES

Have Appellants shown that the Examiner erred in rejecting claims 21, 22, and 25 under § 102(b) as being anticipated by Lin ('369), because Lin ('369) fails expressly or inherently to teach a via having “substantially the same diameter throughout the depth of the via hole” or “at least one-half the depth” and a tapered sidewall as claimed?

Have Appellants shown that the Examiner erred in rejecting claim 21 under § 103(a) over Yu and Lin, because the applied references neither teach nor suggest verticality of via walls or a via having an aspect ratio greater than one as claimed?

Have Appellants shown that the Examiner erred in rejecting claims 23, 24, 26, and 27 under § 103(a) over Lin ('369), because Lin ('369) fails to teach or suggest a tapered via sidewall extending at least a specified depth into a via?

FINDINGS OF FACT

The record supports the following Findings of Fact (FF) by a preponderance of the evidence:

Present Application

1. The application Specification discloses that a via aspect ratio is the “ratio of the square of the via depth to cross-sectional area of the via-opening,” and that “the preferred range of via depth to via width values [is] greater than 4 to 1” (¶ [0030]).

Lin ('369)

2. Lin ('369) discloses structure for semiconductor electrical components and methods for manufacturing these semiconductor

- components that include opening patterns into assembled layers (col. 1, ll. 17-23; col. 7, ll. 61-63).
3. A disclosed Lin ('369) pattern of openings 22, 36, and 38 is etched through a polyimide layer 20, which is deposited on a semiconductor component passivation layer 18. As shown in figures 1 and 5a, these openings 22, 36, and 38 have substantially the same diameters throughout their depths (col. 7, ll. 54-63; Figs. 1 and 5a).
 4. Lin ('369) further discloses that an "aspect ratio of vias 22/36/38 . . . of about 5 is acceptable for . . . via etching and . . . filling," and that the openings 22/36/38 can have a diameter "in the range of approximately 0.5 μm to 30 μm . . ." (col. 8, ll. 43-44, col. 9, ll. 24-25).
 5. Shown in Lin ('369) figure 10 (reproduced below for reference) are vias with tapered upper half sidewalls and contact plugs 50 formed in the vias.

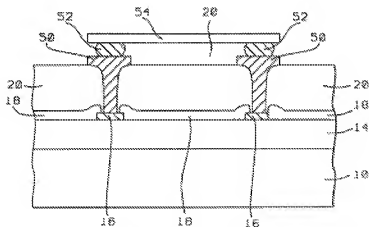


FIG. 10

Figure 10 of the present application shows a cross section of polyimide layer 20 with contact plug 50 filled vias

Yu

6. Yu discloses a method for forming vias through microelectronics component dielectric layers (Abstract).
7. A series of Yu apertures 25a, 25b, and 25c are disclosed as being trenches formed through a dielectric layer 16, and are shown as having parallel vertical walls (col. 10, ll. 40-67; Fig. 3).

Lin

8. Lin discloses a method for manufacturing integrated circuits, including etching parallel vertical walled vias 7 through a polyimide layer 5 (¶¶ [0003], [0042]; Fig. 1).
9. The disclosed diameter for the Lin opening 7 ranges from 0.5 μm to 3.0 μm , and Lin further discloses that the “aspect ratio of opening 7 is designed such that filling of the via with metal can be accomplished (¶ [0050]). Further, disclosed is that a via 7 “aspect ratio of about 5 is acceptable for . . . via etching and . . . filling” (¶ [0044]).

PRINCIPLES OF LAW

Product-by-Process Claims

“The patentability of a [product-by-process claimed] product does not depend on its method of production. If the product . . . is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process.” *In re Thorpe*, 777 F.2d 695, 697 (Fed. Cir. 1985) (citations omitted). *See also In re Marosi*, 710 F.2d 799, 803 (Fed. Cir. 1983) (“Where a product-by-process

claim is rejected over a prior art product that appears to be identical, although produced by a different process, the burden is upon the applicants to come forward with evidence establishing an unobvious difference between the claimed product and the prior art product.” (citations omitted)).

Anticipation

The inquiry as to whether a reference anticipates a claim must focus on what subject matter is encompassed by the claim and what subject matter is described by the reference. As set forth by the court in *Kalman v. Kimberly-Clark Corp.*, 713 F.2d 760, 772 (Fed. Cir. 1983), it is only necessary for the claims to “‘read on’ something disclosed in the reference, i.e., all limitations of the claim are found in the reference, or ‘fully met’ by it.”

Obviousness

An Examiner, in rejecting claims under 35 U.S.C. § 103, must establish a factual basis to support a legal conclusion of obviousness. *See In re Fine*, 837 F.2d 1071, 1073 (Fed. Cir. 1988). The Supreme Court has further explained that an obviousness rejection must be based on:

“‘some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness’ . . . [H]owever, the analysis need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ.”

KSR Int’l v. Teleflex, Inc., 550 U.S. 398, 418 (2007) (quoting *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)).

There is a presumption of obviousness for an invention claimed in a range disclosed in the prior art. “[T]he presumption will be rebutted if it can

be shown: (1) That the prior art taught away from the claimed invention . . . ; or (2) that there are new and unexpected results relative to the prior art” *Iron Grip Barbell Co., Inc. v. USA Sports, Inc.*, 392 F.3d 1317, 1322 (Fed. Cir. 2004).

ANALYSIS

Anticipation by Lin (‘369)

We do not find error in the Examiner’s anticipation rejection of claims 21, 22, and 25 based on Lin (‘369).

Claim 21

Appellants assert that the recited “novel process results in a device that has never before been accomplished on a sub-micron or micron level,” and that the Examiner “erroneously” relies on Lin (‘369) figure 5a, which according to Appellants is a “crude drawing . . . that represents an entirely different concept and invention” (App. Br. 10).

The Examiner and we conclude that the patentability of claim 21 depends on what is claimed for the product, i.e., device, and not the recited method of production for the device (Ans. 10, 11). *See In re Thorpe*, 777 F.2d at 698.⁴ Therefore, our review is exclusively directed to the device’s recited structure limitations, which the Examiner indicates to be as follows:

⁴ Appellants, in arguing patentability of other appealed claims, repeat their reliance on process limitations. Since all appealed claims are drafted in product-by-process format, the Examiner correctly has explained that patentability for such claims does not turn on any recited production method limitation. Accordingly, we do not further address Appellants’ production process premised assertions.

As a device, the physical aspect of the claim includes: a via hole being formed in a polymer layer having an aspect ratio (defined as depth/width ratio) of which is greater than 1 and is of substantially the same diameter throughout the depth of the via hole. Other than “via hole comprises an aspect ratio which is greater than 1”, the actual size of the via hole, being submicron, etc., has never been recited in the claim.

(Ans. 11).

The Examiner then indicates that Lin ('369) figure 5a “teaches such a device” (*id.*). Again we concur with the Examiner, because we also find Lin ('369) figure 5a teaching a pattern of openings 22, 36, and 38 etched through a polyimide layer 20, with openings having substantially the same shown diameter throughout their lengths (FF 3). Though not explicitly cited by the Examiner, we further find that Lin ('369) discloses that “an aspect ratio of vias 22/36/38 . . . of about 5 is acceptable for . . . via etching and . . . filling” (FF 4). Accordingly, from this record we find that the claim 21 covered device reads on the Lin ('369) figure 5a taught device vias, and we, therefore, are not persuaded by Appellants' arguments.

For these reasons, we find, as does the Examiner, that the claim 21 recited device is anticipated by Lin ('369). We will sustain the Examiner's rejection under § 102(b) of claim 21.

Claim 22

The Examiner and we find Lin ('369) teaching a device via having a sub-micron diameter, and also having an aspect ratio greater than one (Ans. 4; FF 4).

Appellants focus their arguments “on the question of whether Figure 10 in Lin ‘369 teaches both the claimed via geometry and how to create such a via” (Reply Br. 2). What Appellants assert is that Lin (‘369), aside from figure 10, which is relied on by the Examiner, lacks disclosure “that there is tapering of the [via] sidewall, much less how to achieve it” (App. Br. 10).

The Examiner responds with findings that concur with ours; namely, that “as shown in figure 10, Lin teaches a via . . . having tapered (top portion) and vertical sidewall (lower portion)” (Ans. 12; FF 5). Continuing, the Examiner indicates that “[d]rawings and pictures can anticipate [a] claim if the[y] clearly show the structure which is claimed. *See In re Mraz*, 455 F.2d 1069, 173 USPQ 25 (CCPA 1972)” (Ans. 12). We also note that the Federal Circuit has further declared that “a drawing in a utility patent can be cited against the claims of a utility patent application even though the feature shown in the drawing was *unintended or unexplained* in the specification of the reference patent” *In re Aslanian*, 590 F.2d 911, 914 (CCPA 1979) (citations omitted) (emphasis added). Accordingly, based on the record, we conclude that the claim 22 covered device reads on the Lin (‘369) figure 10 vias, and we, therefore, are not persuaded by Appellants’ arguments.

We conclude, as does the Examiner, that the claim 22 recited device is anticipated by Lin (‘369). We will sustain the Examiner’s rejection under § 102(b) of claim 22.

Claim 25

Appellants’ arguments with respect to claim 25 (App. Br. 11; Reply Br. 2-5) are merely reiterations of those we considered with respect to claim 22 above. Accordingly, we will sustain the Examiner’s rejection of claim 25 for similar reasons.

Obviousness over Yu and Lin

Claim 21

We do not find error in the Examiner's obviousness rejection of claim 21 over Yu and Lin.

The Examiner and we find Yu disclosing at least one aperture 25a, 25b, or 25c, and these apertures are shown in Yu figure 3 with vertical walls (Ans. 7; FF 7). From these findings the Examiner concludes that Yu "teach[es] all the features of the claim with the exception of explicitly disclosing the aspect ratio of the via" (Ans. 7). Turning to Lin, the Examiner finds a taught "via (7) defined in a polymer layer (5) having an aspect ratio of greater than 1 . . ." (*id.*). We also find Lin disclosing that a via 7 having an "aspect ratio of about 5 is acceptable for . . . via etching and . . . filling" (FF 9).

Appellants apparently assert, *arguendo*, that "Lin may disclose a via with an aspect ratio greater than one, however there is no teaching, showing or suggestion of vertical sidewalls of the via hole which would result in a via hole having substantially the same diameter throughout it's [sic] depth" (App. Br. 11). Irrespective of whether Appellants are referring to either Lin vias 7 or Yu apertures 25a, 25b, or 25c, we find both references showing the respective walls to be both vertical and parallel (FF 7, 8). Therefore, we are not persuaded by this argument, because in having parallel vertical walls the Yu and Lin subject holes consequently have substantially the same diameters throughout their depths.

Alternatively, Appellants traverse "the Examiner's rejection as an obvious matter of design choice to define a via having an aspect ratio greater than 1" (App. Br. 12). The Examiner responds with a reference to a Lin

disclosure and relevant case law. “[T]he aspect ratio of opening 7 is designed such that filling of the via with metal can be accomplished” paragraph [0050]. From this teaching, the aspect ratio of the via is clearly an obvious design choice. *In re Rose*, 105 USPQ 237 (CCPA 1955).” (Ans. 14). Beyond teaching that the aspect ratio of Lin via 7 is designed for accomplishing metal filling, we also find Lin explicitly disclosing that a via 7 “aspect ratio of about 5 is acceptable for . . . via etching and . . . filling” (FF 9). Consequently, we are not persuaded by Appellants’ arguments, and we will sustain the Examiner’s rejection under § 103(a) of claim 21 over Yu and Lin.

Obviousness over Lin (‘369)

Claims 23 and 24

Appellants collectively argue dependent claims 23 and 24 (App. Br. 13, 14), which respectively recite that their base independent claim 22 covered “via includes a tapered sidewall extending at least one-third [or up to one-half] of the depth thereof.”

The Examiner identifies that these claims exclusively recite a “particular chosen dimension.” In view of this claiming, the Examiner, relying on *In re Woodruff*, 919 F.2d 1575, 1578 (Fed. Cir. 1990), concludes the claims are obvious over Lin (‘369) because Appellants’ “specification contains no disclosure of either the critical nature of the claimed extending of the tapered sidewall in the range from one-third to one-half [or] any unexpected results arising therefrom” (Ans. 9) (emphasis deleted).

Appellants’ argument is that the claims are “supported . . . in the specification at paragraphs [0027], [0033], and [0036] . . .” (App. Br. 13). Appellants assert Specification “support,” but do not argue, and we have not

identified, any teaching or suggestion in the present record for any “critical nature” or “unexpected results” associated with how far a tapered sidewall extends into a via, including any teaching away from this claimed subject matter. *See Iron Grip*, 392 at 1322. Consequently, we are not persuaded by Appellants’ argument.

We will sustain the Examiner’s rejection under § 103(a) of claims 23 and 24 over Lin (‘369).

Claims 26 and 27

Appellants collectively argue dependent claims 26 and 27 (App. Br. 13, 14), which respectively recite that their base independent claim 25 covered “via includes a tapered sidewall extending at least one-third [or up to one-half] of the depth thereof.”

Appellants’ arguments with respect to claims 26 and 27 (App. Br. 13, 14) are merely reiterations of those we considered with respect to claims 23 and 24 above. Accordingly, we will sustain the Examiner’s rejection of claims 26 and 27 for similar reasons.

CONCLUSIONS

Appellants have not shown that the Examiner erred in rejecting claims 21, 22, and 25 under § 102(b) as anticipated by Lin (‘369).

Appellants also have not shown that the Examiner erred in rejecting claim 21 under § 103(a) over Yu and Lin.

Appellants further have not shown that the Examiner erred in rejecting claims 23, 24, 26, and 27 under § 103(a) over Lin (‘369).

DECISION

The Examiner’s decisions rejecting claims 21-27 are affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED

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LaRiviere, Grubman & Payne, LLP
P.O. Box 3140
Monterey CA 93942